**BEFORE THE**
**FEDERAL COMMUNICATIONS COMMISSION**

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| In the Matter of | GN Docket No. 12-354 |
| Amendment of the Commission's Rules with Regard to Commercial Operations in the 3550-3650 MHz Band | |

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**Comments of Wi-Plan Wireless Consulting**

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## Summary

The FCC is proposing Citizen Band Services (CBS) in the 3.55 to 3.65 GHz band. This short paper examines the use of this band for Disaster Recovery Communications, in conjunction with Cognitive Radio (CR) technology, and proposes regulatory and technical approaches to facilitate its use. These could also be used to support public safety and civilian communications in other bands during disasters.

# Introduction and Background

An important area in which CR technology could play a major role is in communications recovery after large disaster. As recent experience has shown again, there will always be a disaster which is too big for communications infrastructure to survive. Painful experience highlights the need to quickly recover communications operability in large incidents such as earthquakes and storms. First responders and Federal users may find that their radio towers, or backhaul and interconnects may be damaged. Civilian cellular communications systems may also be damaged or rendered inoperable due to loss of power. The shortage of information and guidance to the population can wreak havoc and jam any remaining communications.

Several papers on disaster recovery communications have been published[1][2][3] through the WInnForum, and APCO. Also the FCC wrote a key white paper[4] and hosted a panel on Deployable Aerial Communications (DACA) in 2011[5] which included a presentation by this respondent. They proposed bringing in space based and airborne infrastructure to replace damaged ground facilities at VHF, UHF 700/800 MHz and Cellular bands, including the new 700 MHZ LTE and public safety bands.

However, there has always been concern that when the extent of the damage is unknown, replacement transmitters in all of these bands may unwittingly interfere with transmitters that survived the disaster and are still operating. Furthermore, when the temporary replacement is airborne and raised above the surrounding terrain at a height it's frequency is not licensed for, it could interfere with unaffected radio systems that are well outside the disaster area. It should be noted that there is no opportunity to formally coordinate the temporary replacement through normal FCC processes in such circumstances. Airborne platforms may also need to form self-organizing networks (SON) to relay information among themselves in order to reach other transmitters and terrestrial links.

# The Proposal

## 3.6 GHz CBS Band Benefits

The use of a Citizens Band Service (CBS) at 3.6GHz with flexible rules could permit the systems discussed above to develop appropriate flexible protocols for different types of communications related to disaster recovery. Electronic beam forming directional antennas at 3.6 GHz for inter-platform SON based relay communications could be used to minimize interference on the ground. These platforms

[1] Devasirvatham, D.: "A Modest Proposal: Recovering Operability and Interoperability After Large Incidents", APCO Public Safety Communications Magazine, pp 26-28, May 2011 (Invited)

[2] Devasirvatham, D.: "Recovering Communications After Large Disasters", Software Defined Radio Forum Conference SDR'11-WInnComm-Europe, pp 61-65, June 22-24, 2011 (Invited)

[3] Devasirvatham, D., Neal, J., Tompsett, C., Link, K.: "Hybrid Communications Recovery After Large Disasters", Mission Critical Communications Magazine, March 2013 (Invited)

[4] Federal Communications Commission: "The Role of Deployable Aerial Communications Architecture in Emergency Communications and Recommended Next Steps", http://www.fcc.gov/document/staff-white-paper-deployable-aerial-communications-architecture , September 2011

[5] Federal Communications Commission: Workshop/Webinar on Deployable Aerial Communications, http://www.fcc.gov/events/workshopwebinar-deployable-aerial-communications-architecture October 31, 2011

may also interact directly with LTE (and other protocols) based user terminals/smart phones in the 3.6 GHz band for first responders, Federal and Local agencies on the ground. While the rules of a CBS may preclude mission-critical reliability, they could nonetheless facilitate communications where none existed due to the dire circumstances. They also provide some leeway since other secondary systems in the band could be designed to tolerate some minimal interference.

### Cognitive Systems Benefit All Bands

Additionally, Cognitive Radio Systems techniques could be very useful here; not only at 3.6 GHz, but also in all the other bands described above, to further minimize interference. Databases of existing public safety, civilian and federal radio systems, their locations, frequencies, emission modes and intensities can be generated, either from the FCC ULS and NTIA database or from active scans prior to the disaster if that was possible, using fly-bys. Even the active pre-incident scans could be guided by the FCC and NTIA database to determine ground truth and weed out inactive transmitters leftover in the FCC and NTIA database. When the replacements are brought in after the disaster, whether on the ground or in the air, the detected RF environment could be checked against the database, and active transmitters avoided by targeted spectrum sensing. Also, by examining the control information embedded in the surviving transmissions, the identity of the surviving systems could be verified.

Furthermore, additional layers of autonomous and human-assisted decision making can be implemented to decide which transmissions should be replaced to maximize the benefits of the equipment that is brought in, as well as configuration of its waveform and identifying information to sufficiently mimic the damaged system. Self-learning system could further refine these initial approaches to suit the requirement of the disaster. These represent higher order functions of cognitive systems technology.

Finally, as the ground infrastructure is repaired or brought back on air, its presence could be detected by periodic listening and trigger the automatic shutdown of the temporary supporting systems.

### Regulatory Approach and Benefits

This approach, fleshed out further, could help ease the concerns of the FCC, first responders, and commercial carriers since the procedure could be controlled by rules and standard operating procedures (SOP) previously agreed to by the concerned parties and refined over successive events. A Presidential Declaration of Emergency may be needed to set this approach in motion. Furthermore, in the future, communication systems protocols could be required to actively assist this process, whereby surviving systems could exchange context and status information with the equipment that is brought in, hence assisting them in the decision making process.

## Conclusions

The FCC is proposing Citizen Band Services (CBS) in the 3.55 to 3.65 GHz band. This submission examined the use of this band for Disaster Recovery Communications, in conjunction with Cognitive Radio (CR) technology, and proposed regulatory and technical approaches to facilitate its use. These could also be used to support public safety and civilian communications in other bands during disasters.

Respectfully Submitted

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